

## A STUDY OF WILD AND HAND REARED KILLDEERS

BY EMMA DAVIS

IT has long been accepted that, in common with many other shore birds, the male of the Killdeer (*Oxyechus vociferus*) takes part in incubating the eggs and perhaps in caring for the young. Audubon (1835:193) in writing of this species uses the expression, "the parents who sit alternately on the eggs," but he cites no specific observation. The statement was apparently accepted without substantiation until Pickwell (1930:501-502) reported two incubating males which he had collected in 1929. In the Finger Lakes District of New York, I have carried on an investigation of this and related problems by intensive observation of marked birds at six nests and of unmarked birds at nine other nests during three successive breeding seasons. One of these nests was that of birds reared in captivity. I am deeply indebted to A. A. Allen of Cornell University for help and guidance in my work.

### WILD BIRDS

During the first season I confined myself largely to a close study of three nests. From an observation blind set up within three feet of each nest, I made daily observations as long as the nests were occupied.

*Egg laying and incubation.* I found the first nest April 19, when it contained only one egg. The second egg was laid April 20, the third April 22, and the fourth April 23. On May 15, while incubation was in progress, I marked one of the attending birds by spraying its breast with red color as it sat on the nest. It soon became clear that as the period neared its close the marked bird was assuming the greater proportion of the task. At 9:45 A.M. on May 20 all four eggs had hatched, giving an incubation period of about 27 days.

*Exchanging places.* None of the Killdeers I observed made any elaborate ceremony of changing over. When returning to resume incubation after an "off" period, the mate would usually announce its coming by a signal call in the air, a long *dee-ee-ee* with rising inflection. The sitting bird would answer with a loud *killdee killdee* and flutter its wings but remain on the nest; or it would call *pup pup pup* softly and toss dried weed stems about. The mate would always alight about 30 or 40 feet away and come on foot to the nest. Sometimes when it reached the nest the sitting bird would rise and walk away. At other times it would remain on the nest until it appeared that the mate with lowered head and breast was shoving it off. Both birds engaged in soft cluckings as they exchanged places. Often the sitting bird would run to meet the mate when it alighted, and the pair would copulate. Then the mate would go to the nest and begin incubation. At other times the sitting bird would leave the nest before the mate returned and, after running 30 or 40 feet, would fly away. The length of the attentive

periods varied from 15 to 90 minutes. The bird relieved of duty sometimes remained near, feeding within a radius of a hundred yards, or standing quietly within a few feet of the nest. Sometimes it flew off an eighth of a mile to a common feeding ground where several Killdeers were usually to be found.

*Behavior on the nest.* During the long periods of sitting, the Killdeers played with the nesting materials. The sitting bird would pick up dried stems of weeds and toss them about or, taking one of the small stones that rimmed the nest in its beak, it would lean over and repeatedly tap the ground with the stone. Sometimes it relaxed and slept. On hot days the incubating bird often stood over the eggs instead of sitting. The birds altered the position of the eggs at times by vigorous movements of the wings and feet. From the blind I could hear the eggs tapping against each other. Rarely the bird half rose and moved them with its beak. When the chicks began peeping in the shell the parent would cluck quietly as if in answer.

*Hatching.* At the nests I studied, the Killdeer chicks could be heard peeping in the shell from 18 to 48 hours before they emerged. My records show that pipping of shells occurred from 18 to 36 hours before the birds actually hatched. The period from the hatching of the first chick to the hatching of the last varied from 6 to 16 hours. The parents picked up the shell and flew away with it almost immediately after the hatching.

*Care of young.* On the day the eggs hatched I enclosed a space around the nest about six feet in diameter with a 12-inch fence of roofing-tin so that the young could not escape. They were confined within this area for 18 days. Fly larvae for food and water for drinking and bathing were provided.

Since Killdeers almost invariably approach the nest on foot, the fence presented a real obstacle to this pair, but they soon solved the problem by hopping to the top from the outside and down again on the inside. Here they attended their offspring, readily accepting the unnatural conditions. Near nightfall, however, on the first six days, they made frantic endeavors to lead the young away from the nest site. One parent would come into the enclosure, give the brood call, a harsh *pup pup pup*, then hop to the top of the fence and down on the outside, obviously expecting the brood to follow. It would continue this performance for an hour or more, pausing only for brief periods of brooding. There was a flat stone about two inches high within the enclosure, which the parents used for a "take off." After watching several times, the downy young began running to the same stone, flapping their diminutive wings and trying to jump over the fence at the spot where the parent had disappeared. I did not observe whether these performances continued longer than the six days. At night the parent could be found

brooding the young within the enclosure. Apparently no effort was ever made by the adults at this or other nests similarly enclosed to lift the young over the obstruction, as some species of rails do (Pettingill, 1938:414; Allen, 1934:202). In my observations of Killdeers I saw nothing to indicate that the young were ever carried by their parents as suggested by Pickwell (1925:492, 496).

Brooding, guarding against enemies, and warning of danger appear to be the extent of the parents' responsibilities. These duties are performed with a high degree of success. Of five broods I confined within uncovered enclosures, with no protection against hawks or other predators, only one brood came to grief. The indications were that these young had been eaten by a cat.



Figure 1. Young Killdeers within the enclosing fence the day after hatching.

For the first few days after the eggs hatched, both parents were on hand; as the chicks grew older they were left more and more to the care of one parent, but the mate very soon appeared whenever the bird on duty gave the danger call, a sudden sharp and rapid *dee-dee-dee*.

*Attentiveness at other nests.* At the second and third nests in 1931 my results were the same as at the first. By marking for identification I found one bird of each pair to be the more attentive during the latter part of the incubation period and afterwards to the young. At two nests

in 1932, observed through the incubation period, I again noted one of each pair to be the more attentive. Circumstances prevented me from collecting these "attentive" individuals to ascertain their sex. The sexes in this species are practically identical in plumage and size. Hiatt and Flickenger (1929:321), after observing unmarked pairs in the mating act, concluded that female Killdeers are larger than the males. But the measurements of adult males and females given by Ridgway (1919:100) indicate a variation in size too slight to be relied upon for field identification of sexes.

#### HAND REARED KILLDEERS 1932

From each of the two nests in 1932, I took three eggs as soon as I saw signs of hatching and put them into an incubator. All but one of the eggs hatched normally.

I kept the young Killdeers in large cardboard cartons for several days. Small, portable brooders furnished warmth. When I lowered the brooder into a box the young would run to meet it, uttering the soft *dee dee* note I had heard used by wild Killdeer chicks at the beginning of a brooding period. They would rest under the brooder a few minutes, run out to eat or drink, and then run back to the brooder.

At first I gave them only fly larvae for food. When they were 10 days old I offered them lean beef ground fine and hard boiled egg run through a sieve. This proved acceptable and became their staple diet. Occasionally I added sour milk and ground liver. The food was placed in shallow pans, and an abundant supply was kept before the birds at all times. Water and gravel were always available.

Five newly hatched Killdeers picked up in the field were put in with the incubator birds and reared with them. Each of the captive birds was banded. At the end of a week I put the young in a turkey pen. This was placed above the ground on uprights, thus minimizing the danger of predators. The walls on two sides and part of the roof were replaced by half-inch wire netting to ensure light and air. The floor space (3 x 18 feet) was spread with a thick layer of garden soil, sand, and gravel. Wide, shallow pans of water made tolerable wading pools. An observation blind set up beside the pen made it possible to watch what went on inside at any time.

One of the birds, a weakling at birth, died when seven days old; another died when six weeks old from an infection which entered by way of an injured toe. The others thrived and grew into normal healthy Killdeers.

When cold weather came, Professor Allen kindly offered to winter the birds in a brooder house that gave adequate protection and opportunity for exercise. The place was not heated, but the drinking water was kept from freezing by the use of small burners under the pans. The winter food consisted of a commercial pheasant meal with generous additions of hard-boiled egg.

## HAND REARED KILLDEERS 1933

All but one of the birds survived the winter, and with no significant loss of weight. In early March I again assumed their care, housing them in the same quarters they had occupied the summer before.

*Courtship behavior.* By the middle of April all of the birds were exhibiting what appeared to be courtship behavior. At times they would crouch on the ground and raising the tail and hind part of the body would sway slightly from side to side while uttering a loud rapid *killiee killiee*, a call with a different rhythm from the usual *killdee kill-dee*. At other times they picked up from the floor of the coop the small stones commonly used for nesting material by Killdeers in this locality and dropped them at random. There was also considerable fighting among the members of the flock. So far I could discern no appreciable differences in behavior pattern. Experimentally I segregated any two that showed interest in each other, not knowing whether they were male or female.

*Making the nest.* On May 7, after three weeks of these seemingly aimless performances, one of the birds began definite nest making. For three days bird No. 107 had defended a certain small mound of earth where it would sit in the incubating position and give the loud mating call of *killiee killiee*. In making the nest the bird crouched low on this spot rotating slowly as it scratched the dirt loose with its feet and threw it out of the scraped area with vigorous backward kicks, all the while loudly calling *killiee killiee*. At intervals it sat quietly in the nest giving the soft *pup pup* call which is used during incubating and brooding. I cannot say how long was required for the actual scraping since it was impossible for me to observe continuously on that day, but on frequent visits from 8 A.M., when the nest making began, until 8 P.M., I found the bird occupied with the nest. At 8 P.M. the nest cavity was the size and shape usual in Killdeer nests, but it had no lining. The next day, May 8, I removed the other birds and placed them in a different cage, then segregated each in turn with No. 107. During this time No. 107 continued to run to the nest at frequent intervals, assume the courtship posture, and give the courtship call. It also continued the scraping and kicking motions. On May 12 when I put No. 105 in the coop with No. 107 these demonstrations ceased.

*Mating behavior.* On May 14 I saw the two segregated birds copulating; No. 107, the bird that had made the nest, was unmistakably the male. With none of the Killdeers I observed was the act of coition either preceded or followed by a special ceremony; and it was seldom accompanied by sound, never by fluttering of wings. Sometimes the male ran to the female, who would stand motionless with lowered head while he hopped lightly upon her back. Again the female would run

to the male, face away from him, and stand waiting. Conjunction was very brief. Throughout the entire period of nest building and incubation, Killdeers copulate frequently; I have seen several pairs repeat the act three or four times a day, sometimes twice within an hour. My captive birds were last seen copulating on the day the eggs hatched. This pair, No. 105 and No. 107, were the only ones of the captive birds to pair or make a nest although two of the other birds continued a gradually diminishing courtship behavior for several weeks.

*Egg-laying, incubation, and brooding.* On May 17 the female contributed a few small stones for the nest. I never saw the birds placing these stones, but eventually the nest came to have a definite lining. Sometimes, after incubation began, the female would get up from the eggs and standing a foot or two away would toss the small stones over her shoulder in the direction of the nest. On May 19 the nest contained the first egg. The next morning I found it in a far corner of the coop with the shell broken, probably by a deer mouse. A second egg was laid on May 22, a third on May 24, and a fourth on May 26. While marking the eggs for identification I accidentally punctured the shell of one, leaving only two in the nest. But on May 28 the female laid her fifth egg. All five eggs had been perfect in shape and appeared to be normal in size.



Figure 2. One of the captive-bred Killdeers feeding from the author's hand.

During the laying stage the female had little concern for the nest. She was seldom disturbed by my presence and would stand quietly watching me. Often she ate from my fingers. The male would sneak to the nest and cover the eggs when I drew near, but would tolerate my hand at the nest and even permit me to lift one side of his body to show the eggs to a visitor. On two occasions he lunged at me, but did not strike me. As incubation progressed the female became more solicitous for the welfare of the nest, but she was never so uneasy as the male. At this time both birds used the broken wing tactics when I appeared, but would soon desist, and one would return quietly to the nest even while I remained near. Observations were not continuous, but visits were frequent enough to satisfy me that the male assumed an equal share if not the greater part of the incubation duties.

At 6 A.M. on June 21 I found two of the eggs hatched. Late in the afternoon the two chicks had left the nest and had hopped over a three-inch partition inadvertently left in the coop and were making no effort to get back. For a time the female took care of the unhatched egg while the male brooded the young. Presently she apparently lost interest and merely looked on while the male hurried back and forth, alternately brooding the young for a few seconds, and sitting on the neglected egg. By 8:15 it seemed that he also had abandoned the egg; I put it into the incubator, where it hatched at 8 A.M. June 22.



Figure 3. The male Killdeer brooding his four-day old offspring in the coop.

For the first two or three days the female assisted in brooding the young. After that she left them almost completely in the care of the male. She seldom brooded them, and she kept at a distance from them. This behavior recalls the frequent absence of one parent from the nests observed in the fields during the preceding two years. Yet she was always ready to defend the young, giving the warning call and flying at me if I made a motion to pick them up. The captive birds expressed solicitude in the manner of wild birds but not to the same degree.

On June 29 three downy Killdeers which had hatched in the incubator from eggs found in the field, were put into the coop. The adult birds adopted them at once and gave all six birds the same care. They continued to brood until the young were 23 days old.

*The young.* In appearance and behavior all three offspring of the captive birds were entirely normal. They were not weighed until they were nine weeks old, at which time their average weight (67.7 grams) was 2.4 grams more than that of the three adopted birds. At seventeen weeks their average weight (83 grams) was 0.5 grams less than that of their parents taken at the same weighing. In the Cornell University collection, five adult specimens averaged 93.3 grams; 14 adult specimens in the University of Michigan Museum of Zoology collection averaged 87.6 grams.<sup>1</sup> Other measurements (culmen, tarsus, middle toe, wing, and tail) of the captive bred birds at 17 weeks were very close to the average given by Ridgway (1919:100) for 34 adult Killdeers.

#### ACTIVITIES OF THE YOUNG

*Exercising, preening, and relaxing.* When only a few hours old the chicks run with surprising strength and swiftness. On the first day they begin to stretch and flap their wings. At this age they also preen their down. When sunning themselves in their hours of relaxation, the young Killdeers from the day of hatching often assume the resting position of loons, grebes and other primitive birds. At such times they sit back on their heels, holding the body up at right angles to the long outstretched tarsi. I have never seen adult Killdeers take this posture. My notes do not record it after the nineteenth day.

*Roosting.* At night I always found my Killdeers standing or sitting flat on the floor of the coop or in the water pan, though there was ample opportunity for them to use perches from 6 inches to two feet high. In winter they often sat flat in the straw that covered the floor. During sleep the head was often turned and the beak slipped under the scapular feathers. At nightfall Killdeers call to each other, especially when disturbed. One will give the *dee-ee-ee* note with rising inflection; another

<sup>1</sup> I am indebted to George M. Sutton of Cornell University and to Josselyn Van Tyne of the University of Michigan for this information on the weights of wild Killdeers. The weights are the averages of adult birds of both sexes collected during the summer.





Figure 4. A characteristic resting posture of young Killdeers.

will call *killdee* softly as if in answer. After a few seconds the calls are repeated. At intervals the parents give the *pup pup* call used as the brood call.

*Brooding.* Until they are two or three days old Killdeers are brooded for short periods at frequent intervals. Thereafter, daytime brooding is limited to the cool hours of morning and evening and to spells of cloudiness or showers. The brood call of the young is a thin *peep peep*, with a creaking sound difficult to describe but unmistakable. The parent answers with a *peep pup pup, peep pup pup*. Frequently the parent gives the call first as an invitation to brood. Then the young answer and run to the parent. The note of the young as they snuggle under the parent is a soft *dee-ee* with a purring quality.

*Bathing.* I observed a Killdeer taking a full bath when it was 17 days old. The birds I watched usually began the bath by bobbing the whole body in a series of up and down jerks that dipped the hind parts into the water. At the same time the feathers were spread away from the vent. Less frequently they sat down in the water and leaned from one side to the other, then dipped in the beak and threw the water over the back with a jerk of the head. The wings were not fluttered in the bath.

Adults bathed several times a day in warm weather. Sometimes they bathed when there were crystals of ice in the water. I never saw Killdeers take a dust bath.

*Feeding.* Within a few hours after they leave the shell Killdeers begin to peck at small objects around the nest, but they do not really eat until the second day. The parents that I observed never fed the young or called attention to morsels of food. Several times I observed a curious performance, first described in my notes when the incubator birds were four weeks old and I had brought them a large pan of mud scooped from the edge of a pond: "The bird stands in the pan and presses the mud with one foot after the other. The foot that is patting is extended in advance of the other. Meanwhile the bird watches the mud closely. Now and then it probes with its beak. Often it brings out a small worm or a larva. Sometimes the weight of the body is added to the force exerted by the foot." Later, on three occasions I saw this soil patting by birds of different broods in the wet ground around the water pan. Once I saw one of my captive Killdeers tapping as it sat on its tarsi. Audubon (1835:194) mentions the Killdeer "patting the moist ground to force out the inhabitants," and Nice (1942:95) also describes a Killdeer that "lightly pawed the soft mud with one foot, then the other." Kirkman (1937:84), Colthrop (1923:170), and other writers have described this behavior as a method used by a number of gulls and shore birds to obtain worms.

(It was my expectation to continue experimenting with Killdeers in the hope of rearing succeeding generations in captivity, but late in December, 1933, the birds I had were destroyed in a fire.)

#### SUMMARY

The breeding habits of wild Killdeers were studied in 1931 and 1932 at 15 nests in the Finger Lakes District of New York.

The two sexes shared in incubation and care of the young. Sexes were indistinguishable in the field, but the birds at six nests were marked, and one of each pair was observed to be more attentive during the latter part of the incubation period and in the care of the young.

The adult birds continued normal care of the young even though the nests were fenced in to prevent escape of the young.

Parental care consisted of brooding, guarding against enemies, and warning of danger. The young were never fed by the parents.

In 1932 five eggs taken from nests in the field were hatched in an incubator and the young Killdeers hand reared along with five young Killdeers hatched in the field.

In 1933 two of the captive birds mated and produced three young.

The male made the nest. During egg-laying the male was more solicitous for the eggs than the female. He shared at least equally in

the incubation. When the young were several days old the male assumed almost entire care of the brood.

The young were brooded for 23 days.

The three young hatched in captivity seemed entirely normal.

LITERATURE CITED

- ALLEN, ARTHUR A.  
1934 The Virginia Rail and the Sora. *Bird Lore*, 36:196-204.
- AUDUBON, JOHN JAMES  
1835 Ornithological biography, vol. 3. Adam & Charles Black, Edinburgh.
- COLTHRUP, C. W.  
1923 Black-headed Gulls' method of obtaining worms. *Brit. Birds*, 16:170  
(See also pp. 193, 228, 292, and 316 of the same volume).
- HIETT, LAWRENCE D., and FREDERICK R. FLICKINGER  
1929 Speaking of Killdeer. *Bird Lore*, 31:319-323.
- KIRKMAN, F. B.  
1937 Bird behavior. T. Nelson & Sons, London.
- NICE, MARGARET M.  
1942 [Review of "On Piping Plover Feeding," by J. T. Nichols]. *Bird-Banding*, 13:95.
- PETTINGILL, OLIN SEWALL, JR.  
1938 Intelligent behavior in the Clapper Rail. *Auk*, 55:411-415.
- PICKWELL, GAYLE  
1925 The nesting of the Killdeer. *Auk*, 42:485-496.  
1930 The sex of the incubating Killdeer. *Auk*, 47:499-506.
- RIDGWAY, ROBERT  
1919 The birds of North and Middle America. *Bull. U. S. Nat. Hist. Mus.*  
*No.* 50:99-103.

113 NORTH QUARRY STREET, ITHACA, NEW YORK